OPTICAL RESEARCHES ON GARNET.

It has been for a long time known that all garnets, as well as some other isometric minerals (boracite, analcite, alum, senarmontite, etc.), do not show the action on polarized light which would be required by substances crystallizing in the isometric system; and to find out the causes of these optical variations, and the laws which govern them, C. Klein has examined (*Jahrb. min.*, 1883, 87) as many as three hundred and sixty different garnet sections, cut parallel to different crystallographic planes, and from various localities. His researches do not indicate that because garnets frequently show these optical variations we should refer them to some system of crystallography other than the isometric; for garnets from the same locality often show a great variation in optical properties, some crystals being isotrope throughout, others in part uniaxial or biaxial. Others, on the other hand, have tried to explain the optical variations by regarding the various isometric forms as made up of numerous prisms, either uniaxial or biaxial, united at the centre, and whose bases make up the external crystal faces. Others regard the garnet substance as triclinic, and the various optical properties as the result of repeated microscopic twinning of the same.

The chemical composition does not influence the optical structure of the crystals, because the same optical phenomena are observed in garnets of different composition; and in garnets of the same composition, but with different form, varying optical structures are observed, even among crystals from the same locality. The form, however, in which the various garnets occur, governs the optical structure. Thus, in the octahedral garnets from Elba, what is called the octahedral structure is noticed. A section from this garnet cut parallel to an octahedral face, examined in parallel polarized light with crossed nicols, shows a triangular centre, which remains dark, and three fields on either side, which are alternately dark and light as the section is turned, being dark when one of the sides of the triangle becomes parallel to the plane of either of the nicols. In convergent polarized light, the centre shows the dark cross of a uniaxial crystal, while from each of the three sides a dark bar runs out into the side-fields at right angles to the edge. This indicates a crystalline structure made up of eight uniaxial prisms united at the centre of the crystal, and whose bases form the eight faces of the octahedron. A section cut near the centre of the crystal shows six of these prisms radiating out, while the upper and lower ones have been, of course, cut away. What is called the dodecahedral structure is observed on pure dodecahedrons. A section cut parallel to a dodecahedral face shows, in convergent polarized light, the appearance of two optic axes whose plane lies parallel to the longer diagonal of the rhomb. The tetragonal-trisoctahedral structure observed on crystals of that form shows, in sections parallel to the trisoctahedron faces in convergent polarized light, the appearance of two optic axes with very slight divergence, indicating a crystalline structure made up of twenty-four nearly uniaxial prisms united at the centre, and whose bases are the faces of the trisoctahedron. The plane of the optic axes is normal to the symmetry diagonal of the trisoctahedron face. In the hexoctahedron structure the sections show a biaxial structure, and the plane of the optic axes is very variable. By making and examining artificial gelatine crystals, the author was able to imitate many of the optical variations; and these seemed to be related to a contraction working along the edges of the crystal, and normal to its faces. The greater the contraction along the edges in relation to that normal to the faces, so much greater will be the double refracting power of the crystal. The cause, then, of the optical variations observed in many garnets seems to be tension, caused by unequal contraction, and this being influenced largely by the external elements (edges) of the crystal gives to each form its peculiar optical structure.

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GEOLOGICAL NOMENCLATURE.

The following resolutions concerning nomenclature, coloring, etc., were voted by the recent international geological congress: —

I. Nomenclature.

The elements of the earth's crust are the *mineral masses* (masses minérales).

The mineral masses, regarded from the point of view of their nature, take the name of *rocks*. Considered from the point of view of their origin or mode of formation, they are to be called *formations*.

a. Stratigraphical divisions.

Regarded from the point of view of their age, mineral masses may be subdivided according to the following rules: —

1. The word *group* (groupe) is applied to the three or four great divisions. Ex.: *Secondary group.*
2. The divisions of the groups are designated by the word *system.* Ex.: *Jurassic system.*
3. The divisions of systems of the first grade are designated by the word *series* (série), or by the terms *section* or *abtheilung.* Ex.: *Lower oolitic section or series.*
4. The divisions of systems of the second grade are designated by the word *étage*, or by the corresponding terms, *piano* (Italian), *viso* (Spanish), *stage* (English), *stufe* (German), etc. Ex.: *Étage bajocien.*
5. The divisions of systems of the third grade are designated by the term *assise*, or by its strict equivalents in the different languages. Ex.: *Assise à A. Humphresianus.*
6. The French expression *couches* (beds) may be employed as synonymous with *assise.*
7. A certain number of assises combined will bear the name of *substage* (sous-étage).
8. The first element of stratified masses is the *strate* or *couche, schicht* (German), *stratum* (Latin and English), *strato* (Italian), *retek* (Hungarian).

b. Chronological divisions.

9. The word *era* (ère) is applied to the three or four great divisions of time, corresponding to the groups.
10. The length of time corresponding to a system will be rendered by the word *period* (période).
11. The length of time corresponding to a series (section, série, abtheilung) will be expressed by the word *epoch.*
12. The length of time corresponding to a stage (étage) will be expressed by the word *age.*

II. Colors and signs.

1. Crystalline schists, *rose-carmine* (by preference); *bright rose* for the rocks of pre-Cambrian age; *pale rose* for those of indeterminate age.
2. Primary group. Decision referred to the committee of the map of Europe.